

CHROMOSOME COUNTS OF KALMIA SPECIES
AND REVALUATION OF
K. POLIFOLIA VAR. MICROPHYLLA

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Kalmia L. is a small North American genus of woody shrubs belonging to the Ericaceae. There are 7-10 species in the genus depending on the authority. Two taxa, *K. polifolia* var. *polifolia* Wangenh.¹ and *K. p.* var. *microphylla* (Hook.) Rehd. are morphologically very similar and thus have often been placed in the same species. Although these two taxa can be readily crossed (Jaynes 1968), other evidence obtained in the course of genetic studies suggests that var. *microphylla* should be treated as a separate species (*K. microphylla*) as originally done by Heller (1898). In this paper their taxonomic status is considered in the light of cytological and other evidence. Chromosome counts of four other species of *Kalmia* are also reported for the first time.

Previously, Hagerup (1928) reported $n = 12$ for *Kalmia latifolia* and $n = 24$ for *K. polifolia* (as *K. glauca*), counts which are verified by this report. Callan (1941), however, reported $2n = 44$ for *K. polifolia*, which appears to be incorrect.

The counts given here were made during meiosis, usually at metaphase I, on pollen mother cells using an aceto-carmin smear technique. Buds were fixed in ethyl alcohol (95%) and glacial acetic acid (3:1) for at least 24 hours, then rinsed and stored in 70% ethyl alcohol at 4C. Stained preparations were photographed under phase contrast.

The list of species with geographic sources and the counts obtained are presented in Table 1. One or two plants per source were used and a minimum of four figures were ex-

¹Synonym *K. p.* var. *rosmarinifolia* (Pursh) Rehd. There is apparently no evidence to substantiate the existence of a var. *rosmarinifolia* as well as a var. *polifolia* (Wood 1961) as is suggested by the use of the name *K. p.* var. *rosmarinifolia*.

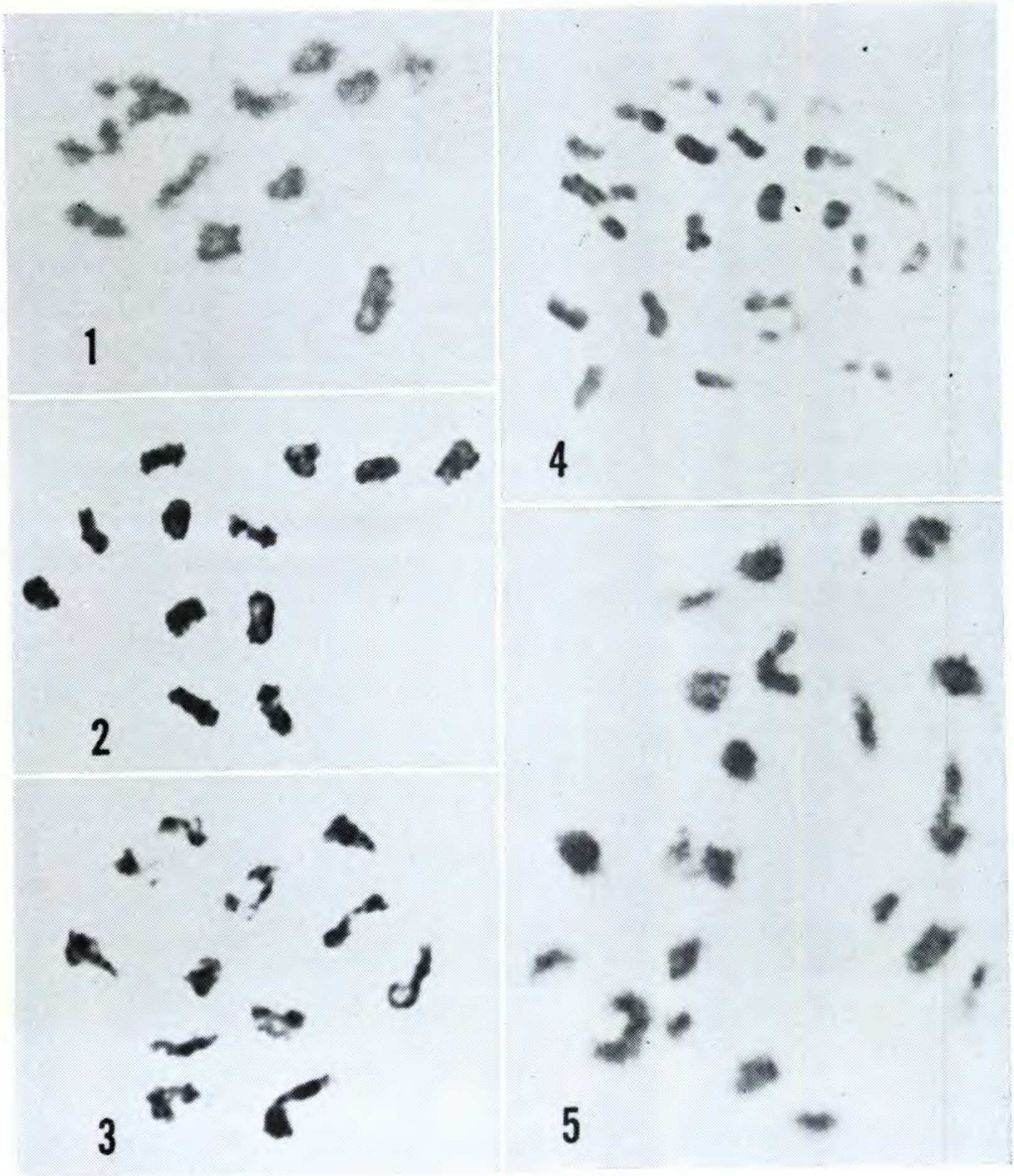


Plate 1414.

Figs. 1-5. Chromosomes of *Kalmia* species, MI, sources in parenthesis. Fig. 1. *K. cuneata* (North Carolina) $n = 12$. Fig. 2. *K. hirsuta* (Alabama) $n = 12$. Fig. 3. *K. microphylla* (Idaho) $n = 12$. Fig. 4. *K. polifolia* (Connecticut) $n = 24$. Fig. 5. *K. polifolia* \times *K. microphylla* (Nova Scotia \times Washington) 14 II, 8 I: n congruent to 36. Magnif. $\times 2,600$.

amined to verify the chromosome number. The haploid chromosome number of all the species is 12, with the exception of *Kalmia polifolia* ($n = 24$). Photomicrographs (Figures 1-5) verify the counts reported and illustrate the small size of the chromosomes.

A summary of the evidence suggesting that *Kalmia microphylla* should be treated as a species distinct from *K. polifolia* follows: 1) The two taxa are geographically separated, *K. microphylla* occurring in western North America at high elevations and *K. polifolia* occurring to the east of the Rocky Mountains and at lower elevations. 2) The plants are different physiologically: *K. microphylla* is a low growing plant adapted to a very short growing season as might be expected of an alpine species. When cultivated under Connecticut conditions it flowers about May 1 and the pollen mother cells undergo meiosis about mid-June, approximately two weeks before *K. polifolia*. 3) The two taxa have completely different crossing relationships with other species in the genus (Jaynes 1968). *Kalmia microphylla* forms hybrids only with *K. polifolia*, whereas the latter taxon can, with difficulty, form hybrids with three other species: *K. angustifolia*, *K. hirsuta*, *K. latifolia*. 4) The chromosome numbers of the two taxa are different (Table 1). Metaphase I chromosome counts of F_1 hybrids of *K. polifolia*-*K. microphylla* using plants of the following sources: Oregon \times Saskatchewan, Oregon \times Maine, Nova Scotia \times Washington, and New Hampshire \times Washington indicate that the hybrids are triploids with $2n = 36$, but the exact number was difficult to verify because of univalents, bivalents, and secondary associations. Figure 5 is atypically clear in this regard, but even here there is some uncertainty in distinguishing bivalents from univalents. As would be expected, all the hybrids between the two taxa are highly sterile. Pollen fertility as determined by acetocarmine staining was 0-15% for the hybrids as compared to 90% or higher for the parental taxa. On the basis of all the preceding information it is concluded that *K. microphylla* is a valid species and not a variety of *K. polifolia*.

Table 1. Chromosome numbers and geographic source of *Kalmia* species.

Species	Geographic source	<i>n</i>
<i>K. angustifolia</i> L.	North Carolina	12
<i>K. cuneata</i> Michx.	North Carolina	12
<i>K. hirsuta</i> Walt.	Alabama	12
<i>K. latifolia</i> L.	Connecticut	12
<i>K. polifolia</i> Wangenh.	Connecticut	24
"	Minnesota	24
"	New Hampshire	24
<i>K. microphylla</i> (Hook.) Heller	Idaho	12
"	Oregon	12
"	Washington	12

Voucher specimens of the material examined have been placed in the herbarium of the Connecticut Agricultural Experiment Station.

Attempts to produce a tetraploid *Kalmia microphylla* with colchicine for the purposes of comparing it to *K. polifolia* have been unsuccessful. But it seems highly unlikely that a doubling of the chromosome number of *K. microphylla* would produce a plant with the longer internodes, rangy habit, and other characteristics of *K. polifolia*. The presence of normal bivalents during meiosis in *K. polifolia* and the apparent lack of trivalents or secondary associations are additional reasons to believe that this species is not an autotetraploid of *K. microphylla*. It also appears unlikely that *K. polifolia* is an allotetraploid of *K. microphylla* and one of the other presently known *Kalmia* species since *K. microphylla* is unable to cross with the other species. However, *K. polifolia* may have originated as an allotetraploid from a hybrid between *K. microphylla* and an ancestral, presently non-existent, species of *Kalmia*.

SUMMARY

Kalmia polifolia and *K. microphylla* have commonly been treated as varieties of *K. polifolia* but from cytological, physiological, geographic, and genetic evidence presented in this report it is concluded that they are valid species. The chromosome number of *K. polifolia* is verified as $n = 24$. *K. microphylla*, *K. angustifolia*, *K. cuneata*, and *K. hirsuta* are reported for the first time, $n = 12$, and *K. latifolia* is verified as $n = 12$.

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